ANTERIOR IMPLANT FOR THE SPINE

TECHNICAL FIELD

The present invention relates to an implant for the spine, and more particularly, but not exclusively relates to an anterior plate for maintaining a bone graft, bone anchorage screws for the plate and means for blocking the screws and preventing any migration of the latter.

BACKGROUND

Spinal plates may be introduced from the anterior to stabilize the cervical spine and maintain in position or secure a bone graft which fills the spaces left by the extraction of at least one vertebral disc and, possibly, part of a contiguous cervical vertebra.

The bone anchorage screws used for fixing this type of plate in position are either unicortical, and therefore short, since they pass through only the anterior cortical of the vertebra, or bicortical, and therefore long, since they extend through the anterior cortical and the posterior cortical. The short unicortical screws utilize a locking element when there is a possibility the screws may back-out. On the other hand, the long bicortical screws, while less likely to unscrew, have other limitations making them less desirable in certain situations.

In practice, the locking element employed up to the present time for unicortical screws is an additional screw which is positioned between two bone anchorage screws and whose head overlaps the heads of these two screws. While there are thin cervical plates without a locking element, the addition of an existing locking element to a given plate design typically results in an increase in plate size, such as the plate's thickness. These additions may also result in a greater plate width than is desirable. Thus, the general desire to further decrease the size of surgical implants indicates a need for new plate and/or locking element arrangements.

DISCLOSURE OF THE INVENTION

Accordingly, one object of the present invention is to provide a unique device for stabilizing a patient's spine.

Additionally or alternatively, another object of the invention is to provide an anterior cervical plate provided with antimigration means for the screws arranged in such manner as to avoid increasing the overall size of the plate.

One form of the present invention is a unique device for stabilizing a patient's spine. In a further form, a slide is incorporated into a spinal plate that may be operable to serve as a locking element.

According to another form of the invention, a plate has means for blocking the bone anchorage screws that comprises at least one slide slidably mounted on the plate so as to be capable of partially covering at least one anchorage screw head, and the slide cooperates with means for retaining it on the head of the screw.

In still another form, the slide is formed by a thin platelet provided with at least one flange and slidable in a complementary cavity provided on the surface of the plate, the cavity having a ramp on which the flange can be engaged; the retaining means are formed by a boss on the plate which clicks into an associated recess when the slide is in its position for blocking and locking the screw. The cavity and the platelet may be so dimensioned that the surface of the platelet is flush with that of the plate when it is placed in its cavity. Consequently, for this form, the overall thickness of the anterior plate may not be increased by the slide.

Further forms, embodiments, objects, aspects and features of the invention will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an elevation view of a cervical spine segment provided with an anterior implant according to the invention for maintaining a bone graft in position.

Figure 2 is a perspective view, to a larger scale, of the anterior plate of Figure 1 provided with a slide for locking two of the screws of the plate.

Figure 3 is a perspective view, similar to Figure 2, showing the plate provided with two slides and two pairs of bone anchorage screws.

Figure 4 is a bottom perspective view, to a larger scale, of one of the screw-blocking slides for the anterior plate of Figures 1-3.

Figure 5 is a top view to a larger scale of the anterior plate of Figures 1-3 provided with two screw locking slides, one of these slides being in the locking position, while the other is in the withdrawn position before locking.

Figure 6 is a cross-sectional view taken on line 6-6 of Figure 5.

Figure 7 is a partial cross-sectional view taken on line 7-7 of Figure 3.

MODE(S) FOR CARRYING OUT THE INVENTION

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is intended. Any alterations and further modifications in the illustrated or described embodiments, and any further applications of the principles of the invention as described or illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Shown in Figure 1 is a cervical spine segment C2, C3, C4, C5, and between the vertebrae C4 and C5 (more usually C4 and C5) of which a bone graft G (partially visible) is disposed, this graft G being covered by an anterior plate 1 whose function is to stabilize the spine and to maintain this bone graft G in position.

Referring additionally to Figure 2, the plate 1 has an elongate shape with two large concave sides 2, 3 connected to rounded ends 4, 5, these large sides 2, 3 extend from the vertebra C4 to the vertebra C5. The plate 1 is provided adjacent to each of its ends 4, 5 with a pair of bone anchorage screws 6, 7 at C4 and C5 which are unicortical and therefore short, and a central screw 8 which is engaged in an oblong opening 9. Each of the screws 6, 7 extends through a corresponding opening 11, 12 which is of generally circular section but has a spherical wall 13, 14 acting as a bearing surface for the corresponding head 15, 16 of screws 6, 7.

Each pair of openings 11 and 12 opens onto a respective cavity 18 provided in the adjacent surface 1a of the plate 1. Formed in this cavity 18, which in the presently-described embodiment opens onto the opposite faces of the plate 1, is a bridge 19 which defines at one end a part of the circumference of the openings 11,12 and extends from the latter to the opposite wall 21 of the cavity 18. However, the thickness of each bridge 19 is less than that of the plate 1 so that the surface 19a of each bridge 19 is situated within the cavity 18 at a distance d from the surface 1a of the plate 1 (Figure 2).

Each pair of bone anchorage screws 6, and each pair of screws 7, is associated with a slide 22 for locking screws 6, 7 after anchorage in the vertebral bodies C4, C5, respectively; and thereby preventing migration of the screws 6, 7. Referring further to Figures 3 and 4, each slide 22 is formed by a thin platelet 22a whose thickness is at the

most about equal to the distance d between the upper surface 1a of the plate 1 and the surface 19a of the bridge 19. This platelet 22a has an elongate shape whose larger dimension ℓ is just equal to the width of the cavity 18 to allow insertion of the platelet 22a in the latter. Each platelet 22a, not cambered in the free state, is generally slightly cambered in order to make it possible to insert it into its housing cavity 18. This insertion is carried out by positioning it on the bridge 19 and applying a force such that its opposite sides 23 slidably and resiliently bear against the retaining ramps 26. Retaining ramps 26 are each defined along a corresponding one of the opposite sides 24 of cavity 18.

Further, each platelet 22a is provided with two lateral flanges 25 which project from the sides 23 under the central part of the platelet 22a. Each of the flanges 25 is adapted to form a shoe 25a slidable along a respective retaining ramp 26 (Figures 2 and 6). The flanges 25 have a width ℓ allowing their insertion in the slots 26a between the sides 24 of the cavity 18 and the opposing sides 20 of the bridge 19, so that their inner faces 27 are placed in sliding contact with the sides 20 of the bridge 19 (Figure 6) when the platelet 22a has been placed in position.

The two large sides 28, 29 of each platelet 22a are concave and the apices 31, 32 of each platelet 22a are rounded so that the rounded apices 31, 32 of the sides 28 close to the screws 6 or 7 are able to partly overlap the heads 15, 16 of the screws 6, 7 when the platelets 22a are in position for locking the screws 6, 7 (Figures 1, 2, 5, 6). Indeed, the openings 11, 12 and the heads 15, 16 are so arranged that, when the screws 6, 7 have been screwed into the vertebral bodies with possibly an inclination in regard to plate 1, their heads 15, 16 have their surfaces in a position in which they are just flush with the underside of the round apices 31, 32.

Referring more specifically to Figures 2-6, means are provided for retaining the platelets 22a in their position for locking the screws 6, 7. In the presently-described embodiment, these means comprise, for each platelet 22a, a central boss 33 projecting from the lower face 33a of the platelet 22a, namely that placed in contact with the surface 19a of the support bridge 19, and a corresponding recess 34 provided in the central part of the bridge 19. Thus, when the platelet 22a reaches the position for locking the screws 6, 7; its boss 33 clicks into the recess 34 and maintains the platelet 22a in this position and prevents it from moving forwardly or rearwardly in its cavity 18.

Referring next to Figures 2, 3, 5, and 7, the first thread 36 of the central screw 8 (i.e., the thread closest to its head 37, See Figure 7) is separated from the latter by a smooth part 38. The diameter of this first thread 36 is larger than that of the smooth part 38 and the width e of the oblong opening 9 arranged to receive screw 8 (See Figure 2). To place the screw 8 in position, it is therefore necessary to force it through the opening 9 and cause the latter to pass beyond the first thread 36. Thereafter, the latter performs the function of means for retaining screw 8 in plate 1.

To place the plate 1 and its locking slides 22 in position on the cervical segment such as C4, C5 of Figure 1, the procedure is the following. Referring generally to Figures 1-7, first of all, after the bone graft G has been placed in position in the discal space previously prepared, the surgeon positions the plate 1 equipped with slides 22 and attaches it by means of screws 6 and 7. Afterwards he makes each slide 22 run from the bottom of its housing cavity 18 until flanges 25 come and stop against screws heads 15 and 16. The latter are then partially covered by rounded tops 31, 32 as shown in Figures 1, 2, 3, and 5 for at least one of slides 22. When the slides 22 reach this position, in which they partly overlap the heads 15, 16; their respective boss 33 clicks into the respective recess 34 so that each slide 22 is locked in this position in which it locks the associated screws 15, 16 against any migration and therefore against any posterior movement.

As can be seen in Figure 6, the slides 22 do not project above the surface of the plate 1 owing to their small thickness which is at the maximum equal to about d, and to the provision of a suitable cavity 18. Thus the surface 22b of the slides 22 is generally flush with surface 1a of the plate 1 whose overall thickness is consequently not increased by the presence of the locking slides 22. The locking platelets 22a do not impose to increase the width of the plate 1 in respect to its minimum width such that the same results from the chosen gap between the axis of screws 6 and 7.

It should be appreciated that the scope of the invention is not intended to be limited to the described embodiments and may encompass variants. For example, boss 33 can be formed on support 19 whilst recess 34 is formed on the platelet 22a. Thus the means 33, 34 for blocking the slides 22 in their locking position may be replaced by any other like system. Further, in another arrangement, a slide is associated with each screw and has a single flange that is suitably dimensioned for this purpose. Optionally, the plate may be provided with only a single blocking slide 22, the second pair of screws being for

example associated with other blocking means, or being absent. Moreover, in further embodiments, the implant according to the invention can be used, not only for the cervical spine, but also for other spine segments, for example thoracic and lumbar, and possibly without any bone grafts. Further, in other embodiments, the screw-locking slide and plate arrangement may be used to reduce undesired migration of one or more screws of a type other than the unicortical variety; and may be used to check undesired migration of other types of fasteners used in addition to or as an alternative to one or more screws.

In one alternative embodiment of the present invention, an implant for the spine includes an anterior plate for stabilizing the spine and maintaining a bone graft that has a number of openings, a number of bone anchorage screws for correspondingly engaging the openings of the plate, and means for blocking the screws and preventing any migration of the screws. This implant is further characterized in that the blocking means comprises at least one slide slidably mounted on the plate so as to be capable of partially covering at least one anchorage screw head. This slide cooperates with means for retaining the slide on the head of the screw.

In further embodiment, an implant for the spine includes: a plate for stabilizing the spine that has a number of openings; a number of bone anchorage screws each operable to engage a corresponding one of the openings of the plate; and means for blocking the screws and preventing screw migration. The blocking means includes at least one slide slidably mounted on the plate to selectively cover at least a part of at least one of the screws and means for retaining the slide on at least one of the screws.

In an additional embodiment, an implant for the spine includes: a plate for stabilizing the spine that comprises a number of openings and defines a cavity adjacent at least one of the openings; a number of bone anchorage screws each operable to pass through a corresponding one of the openings of the plate to engage the spine; and a slide slidably mounted in the cavity of the plate. The slide is operable to selectively cover at least a portion of at least one of the screws mounted in at least one of the openings.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.